

BELLCOMM. INC.

955 L'ENFANT PLAZA NORTH, S.W.

WASHINGTON, D. C. 20024

B70 09054

SUBJECT: Status of the Design of the Color
Television Distribution System of
the SWS of the Skylab Program.
Case 620

DATE: September 16, 1970

FROM: A. G. Weygand

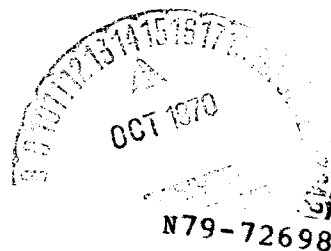
ABSTRACT

The proposed design of the color television (TV) distribution system of the Skylab Saturn Workshop (SWS) is briefly described. The design of this system was not sufficiently complete for review at the Critical Design Review (CDR) of the Multiple Docking Adapter (MDA) because the characteristics of the portable color TV camera to be used in this application had not been defined nor had the design requirements on television distribution been defined. The efforts following the MDA CDR to obtain the necessary characteristics and requirements are summarized.

Subsequent to the MDA CDR, MSC developed plans to provide Apollo type color TV cameras built by Westinghouse Electric Corporation for use in the Skylab Program. However, certain incompatibilities exist in the design of this color TV camera from a Skylab Program application point of view. These include low camera output drive capability and the fact that power and video signal returns are not isolated from each other or from the camera chassis.

Now that the type of portable color TV camera to be used in the Skylab Program has been tentatively selected by MSC and that communications lines between MSC and MSFC have been established at the working level, it appears that definition of the design requirements for the color TV distribution system will be completed in the near future. It appears that proper action is taking place at MSC and MSFC to expedite the design and ensure a compatible integrated cluster color TV system.

(NASA-CR-113665) STATUS OF THE DESIGN OF
THE COLOR TELEVISION DISTRIBUTION SYSTEM OF
THE SWS OF THE SKYLAB PROGRAM (Bellcomm,
Inc.) 4 p



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MEMORANDUM FOR FILE

The color television (TV) distribution system of the Saturn Workshop (SWS) of the Skylab Program will be used to route video signals generated by a portable color TV camera used in the SWS to the interface between the Multiple Docking Adapter (MDA) and the Command and Service Module (CSM) for subsequent transmission to the Manned Space Flight Network (MSFN) via the S-band FM transmitter of the CSM. This distribution system will include: (a) a preinstalled coaxial cable in the SWS, (b) a number of TV input stations located throughout the SWS, and (c) a coaxial switch located in the MDA. A single coaxial cable will be routed throughout the SWS to support all of the TV input stations. TV input stations will be located in the MDA, in the lock of the Airlock Module (AM), and in the crew quarters area and in the forward compartment of the Orbital Workshop (OWS). Prime power to support the portable color TV camera will be provided through the TV input stations from the power supply of that module (MDA, AM, or OWS) in which the TV input station is located. Means will be provided at each TV input station to provide deadfacing of the connector to which the portable TV camera will be connected when a crewman is either mating or demating the portable camera cable connector. The video coaxial switch located in the MDA will enable a crewman to select manually which video signal will be routed to MDA/CSM interface, the video signal from the portable color TV camera, or one of the video signals from the television system of the Apollo Telescope Mount (ATM).

According to the current division of responsibility, the Marshall Space Flight Center (MSFC) is responsible for the design and provision of the color TV distribution system in the SWS and the Manned Spacecraft Center (MSC) is responsible for the design and provision of the portable color TV camera(s). In turn, MSFC has contracted with the Martin Marietta Corporation for the design of the color TV distribution system including the TV input stations and for the required number of TV input stations as government furnished equipment to the McDonnell Douglas Astronautics Company - Eastern Division (MDAC-ED) and - Western Division (MDAC-WD) for installation in the AM and OWS, respectively. At the critical design review (CDR) for the MDA

held during the week of August 24, 1970, it was agreed by representatives of MSFC (Mr. E. H. Reeves, S&E-ASTR-SCD) and MSC (Mr. O. Graham, EE26) that the design of the color TV distribution system was not sufficiently complete to be reviewed in the MDA CDR. The major reason advanced for this incomplete design was the unavailability of definitive characteristics (impedance, bandwidth, white reference level, sync reference level, etc.) of the color TV camera to be provided by MSC for this application in the Skylab Program.

On September 3, 1970, Messrs. Graham and Reeves and other representatives from MSC and MSFC met to discuss the characteristics of the TV camera and the design of the distribution system. At this meeting there was still confusion as to which color TV camera would be used in the Skylab Program. However, subsequent to this meeting MSC has decided tentatively to purchase through Apollo contract extension additional Apollo CSM flight type color TV cameras from Westinghouse Electric Corporation for use in the Skylab Program.

During the September 3 meeting, the characteristics of the camera most likely to be adopted for use in the Skylab Program were defined by MSC. It was noted that the power and video signal returns were not isolated from each other within this camera or from the chassis of this camera. It was also pointed out that the output drive circuit of this camera was incapable of driving up to 170 feet of coaxial cable without significant degradation in the video signal-to-noise ratio (especially at the higher frequencies) and that the deviation sensitivity of the FM modulator of the CSM S-band FM transmitter would have to be modified to accommodate the video signal which would arrive at the modulator at lower levels than the current design calls for. It should be noted that these incompatibilities from a Skylab Program application point of view exist in the Apollo type color TV cameras built by Westinghouse Electric Corporation which MSC now plans to use for the Skylab Program. With these considerations in mind, it was agreed at this meeting that:

- (a) Video signal amplification and shaping would be required and would be provided at the video signal source (either within the camera or in the TV input station) rather than at the coaxial switch in the MDA in order to simplify design of the amplifier.
- (b) A DC-DC converter would be added to isolate the video signal return from module power system ground (location of the DC-DC converter to be either within the camera or in the TV input station) in order to avoid possible noise pickup via a ground loop since the single point ground for the TV system is located in the CSM.

- (c) Isolation of the signal return from the camera chassis or isolation of camera chassis from vehicle structure when in use would be required in order to avoid possible noise pickup via a ground loop.

Also during this meeting, MSFC accepted an action item to set up a formal design review meeting for review of the MMC design of the color TV distribution system following an appropriate time interval after all requirements and color TV camera characteristics have been defined.

In a TWX addressed to Mr. K. S. Kleinknecht, MSC/KA, signed by Mr. L. F. Belew, MSFC/PM-AA-MGR, dated September 14, 1970, MSFC agreed to provide the required video signal amplification in each of the TV input stations and expected MSC to provide the required DC-DC converter and the required isolation of the video signal return from local vehicle structure within the color TV camera unless told differently. It appears that this was the MSFC position before the MDA CDR because the MMC conceptual design for the color TV distribution system presented at the MDA CDR included providing a video amplifier in each of the TV input stations but did not include provision of a DC-DC converter for the purpose of supplying power to the camera. However, it should be noted that a DC-DC converter will be incorporated in each TV input station to supply power to the video amplifier included in that TV input station. It may be possible to power the portable color TV camera from the DC-DC converter included in each TV input station, thereby eliminating the requirement to include a DC-DC converter within the camera. It was agreed during the September 3 meeting that MSC would obtain cost figures for incorporation of a DC-DC converter within the camera and that MSFC would obtain cost figures for increasing the capacity of DC-DC converter in each TV input station to supply the required power to the portable color TV camera.

Now that the type of portable color TV camera to be used in the Skylab Program has been selected by MSC and that communications lines between MSC and MSFC have been established at the working level, it appears that definition of the design requirements for the color TV distribution system will be completed in the near future and that enough information is already available for MMC to begin design of the breadboard for the color TV distribution system. It appears that proper action is taking place at MSC and MSFC to expedite the design and ensure a compatible integrated cluster color TV system.

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